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ABSTRACT

The Computer Assisted Remedial Education (CARE) project developed two computer-assisted instructional (CAI) courses. The objective was to train educational personnel to use diagnostic teaching in working with preschool and primary grade children who exhibit learning problems. Emphasis was placed upon the use of new technology in providing inservice education for professionals who have difficulty in returning to training centers for special instruction. Materials from 13 publishers and numerous other scurces were assembled onto a computer tape, accompanied by over 1500 slides, 1200 hand-drawn graphics, and 1200 audio messages; the frame-by-frame print-out of the final product totalled 78,000 pages. The on-line and companion off-line materials were tested, revised and disseminated by IBM 1500 computer systems placed in mobile CAI laboratories operated by the Pennsylvania State University. The course was also successfully delivered by mobile operations to sites in Indiana, Georgia, Texas, Illinois, and the District of Columbia and was used at several universities. It was concluded that the project was sufficiently successful to warrant the development of other technology-based, mobile in-service courses. (PB)

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TRAINING EARLY CHILDHOOD EDUCATORS: COMPUTER ASSISTED INSTRUCTION COURSES IN DIAGNOSTIC TEACHING — FINAL REPORT

G. Phillip Cartwright
Carol A. Cartwright

Report No. R-61

The Computer Assisted Instruction Laboratory

The Pennsylvania State University

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The Pennsylvania State University
University Park, Pennsylvania

TRAINING EARLY CHILDHOOD EDUCATORS: COMPUTER ASSISTED INSTRUCTION COURSES IN DIAGNOSTIC TEACHING

Final Report

Contract No. OEC-0-72-0653(607)

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G. Phillip Cartwright
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TRAINING EARLY CHILDHOOD EDUCATORS: COMPUTER ASSISTED INSTRUCTION COURSES IN DIAGNOSTIC TEACHING

G. Phillip Cartwright
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ABSTRACT

Nearly 4,000,000 handicapped children in the United States are not receiving special educational services that they require in order to become self-supporting, self-respecting citizens. In order to adequately provide for these children almost 300,000 more specially trained persons are needed to work with handicapped children. In addition there is a serious lack of trained personnel to staff day care centers and preschool programs for both normal and handicapped children. The present methods of training educational personnel cannot provide enough people to meet these needs. This project developed an alternative approach to training educational personnel.

The purpose of this project was to develop two computer-assisted instruction courses in diagnostic teaching. The courses were designed to teach regular elementary and preschool teachers and child care workers how to work effectively with children who have learning problems because of mental retardation, cultural disadvantage, emotional disturbances, and/or learning disability. The emphasis is on inservice training of regular classroom teachers (not special educators) and toward preservice and inservice child care workers. The courses are geared especially toward those persons who may not have the opportunity to return to a college campus or other training center for special instruction in teaching handicapped children.

This project demonstrates the use of a new technology in the development and evaluation of innovative curricula for the education and training of teachers and child care workers. It integrates and makes available relevant data and teaching methods developed by federally financed programs in special education and early childhood education.

Personnel in the Department of Special Education, Division of Academic Curriculum and Instruction and the Computer Assisted Instruction Laboratory at The Pennsylvania State University cooperated to develop and program the CAI courses. Developmental phases have been completed and the courses are ready for dissemination and distribution to other agencies and institutions.

ACKNOWLEDGMENTS

This project was made possible by a grant from the Media Services and Caption Films Branch of the Bureau of Education for the Handicapped, United States Office of Education (Project No. OEC-0-72-0653(607). Project directors were G. Phillip Cartwright and Carol A. Cartwright. Development of the computer-assisted instruction courses took place with the cooperation of the following administrators: Professor Edward Fagan, Chairman, Division of Academic Curriculum and Instruction; Professor Joseph L. French, Head, Department of Special Education; and Professor Keith A. Hall, Director, Computer Assisted Instruction Laboratory.

Ultimate responsibility for course content rests with the principal investigators. However, the successes of the project would not have been possible without major support from a number of professionals who worked with the principal investigators. Most notable was Professor Marjorie E. Ward. Professor Ward devoted a good portion of her time for 18 months and, in function, became a principal investigator. Also, special acknowledgments should be given to the chief programers, Bonnie Shea and Lucille Diehl, and to Terry Bahn, computer operator and systems specialist. Their contributions were invaluable.

All told, some 40 persons were involved in the preparation of these courses. Each person made contributions which assisted in the further development of the project. Names and contributions are given following this section.

A number of publishers have made their materials available to us for reproduction and illustration throughout the courses. Those publishers are listed following this Acknowledgments section. Two publishers deserve special thanks. Fountain Valley Teacher Support System in Reading was made available to us by the Richard L. Zweig Associates. They gave us permission to photograph many of their materials so that we might more fully explain their system. The Select-Ed Company of Olathe, Kansas, publishers of Prescriptive Materials Retrieval System also permitted us to photograph numerous parts of their retrieval system so that we might explain it more adequately. Also, the Select-Ed Company has made copies of their Educational Descriptor Dictionary available to students who take the CARE 2/3 courses.

Finally, the realism of the course would not have been possible without the cooperation of the 160 children and their teachers in preschool programs, public and parochial elementary classes, and church school programs. Hundreds of colored slides were obtained with the cooperation of the children and their teachers. They also provided us with realistic case material, and recordings of classroom activities.

The publishing companies who gave us permission to use excerpts or reproductions of some of their materials are: American Guidance Service, Inc.; Appleton-Century-Crofts; the Publications Department, The Council for Exceptional Children; Curtiss-Wright Corporation; Ginn & Company; Lyons and Carnahan Educational Division of Meredith Corporation; MIT Press; C. V. Mosby Company; Manned Spacecraft Center, National Aeronautics and Space Administration; Prentice-Hall, Inc.; Saskatchewan Newstart, Inc.; Science; and Science Research Associates, Inc.

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FOREWARD

In 1969 under the sponsorship of the Bureau of Education for the Handicapped, The Pennsylvania State University initiated development of CARE 1 (Computer Assisted Remedial Education). CARE 1 is titled Early Identification of Handicapped Children and was developed as a complete college level computer-assisted instruction course dealing with the identification and diagnosis of handicapping conditions in children. The course was aimed toward preschool and primary level teachers of seemingly typical children.

CARE 1 was completed in late 1970 and has been providing instruction for teachers and other educational personnel since that time. Approximately 4,000 persons completed the course during the first three years that it was in existence.

This document reports on the development of two more courses in special education. These courses, CARE 2 and CARE 3, are collectively titled Diagnostic Teaching of Preschool and Primary Level Children. The courses are designed to equip teachers with some basic knowledge about handicapped children so that they might provide better educational programs for those children. Advanced computer technology, branching programs, and extensive pretesting make CARE 2 and CARE 3 suitable for persons with widely varying training and experiences with the handicapped. The courses are useful for preschool teachers and aides who perhaps have not had the opportunity to receive a formal college training program in education. Both CARE 2 and CARE 3 are suitable for regular inservice teachers. Finally, CARE 2 and CARE 3 are appropriate for preservice regular and special education teachers as a first course in methods of teaching handicapped children.

CARE 2 and CARE 3 were designed to complement two other CAI courses in special education, CARE 1, Early Identification of Handicapped Children and CARE 4, Education of Visually Handicapped Children. CARE 4 was developed by the University of Pittsburgh in conjunction with the Penn State CAI Laboratory. Principal investigators were Professor Ralph Peabody and Majorie Ward of the University of Pittsburgh. Professor Ward has since joined the staff of The Pennsylvania State University. CARE 4, like CARE 1, 2 and 3, was designed to be a first-level course in special education for regular teachers. CARE 4 acquaints regular teachers with the problems (and some of the solutions) encountered when attempting to integrate visually handicapped children into the regular classroom.

Personnel in the Department of Special Education, the Division of Academic Curriculum and Instruction, and the Computer Assisted Instruction Laboratory at The Pennsylvania State University cooperated to develop the CARE 2/3 courses for the IBM 1500 Instructional System. Since completion, the courses have been desseminated by IBM 1500 systems in two mobile computer assisted instruction laboratories operated by Penn State. Those mobile laboratories are used to provide instruction to teachers at a variety of locations away from the main campus. In the past locations, in addition to Pennsylvania, have been Georgia, Indiana, Texas, Illinois, and the District of Columbia. It is anticipated that future locations for the mobile operations will be determined by national needs.

In addition to being used in the two mobile laboratories, the CARE courses are used at the main campus of The Pennsylvania State University and at other universities. The thirty-two stations in the Penn State Resident Instruction laboratory provide instruction in the CARE courses to approximately 500 students during each of the four terms of the school year.

This final report for CARE 2/3 is in four volumes. Volume 1 covers the purpose and objectives of the course, a general course description, phases of development, course materials, and results of dessimination efforts to date. Volume 2 is the CARE 2/3 handbook which is not only a summary of the course but also a valuable tool for the student while he takes the course. Volume 3 is a Syllabus which is a detailed accounting of the content and objectives of the CARE 2/3 courses. Finally Volume 4 is a computer tape which contains the entire CAI course in an easily retrievable form. Persons interested in translating the courses to another computer system can obtain a copy of the tape and use their own systems to print out the contents of the tape. The tape contains a complete listing of the CARE 2/3 courses. This listing totals 78,000 computer pages.

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CHAPTER ONE

PROBLEM, ACTIVITIES, AND IMPLICATIONS

Introduction and Overview

This project attempted to improve the quality of teacher preparation in the area of special education. Two computer assisted instruction courses were developed which will provide intensive training in special education concepts to preschool teachers and regular classroom teachers of elementary school children. This report describes the development of the two courses and the dissemination plans.

Justification and Purpose

"There are seven million (one million of preschool age) deaf, blind, retarded, speech-impaired, motor-impaired, emotionally disturbed, or other health-impaired children in the United States who require special education programs. Although these children represent approximately 10 percent of the school population . . . less than 40 percent (of these) are receiving an adequate education." (U. S. Senate, 1973)

Thus, more than four million handicapped children are not receiving the special education programs they require. The present rates of preparation of special education personnel are not sufficient to diminish the gap between needs and delivered services. James J. Gallagher, formerly Associate Commissioner, the United States Office of Education, stated that the present programs for the preparation of specialists to work with the handicapped are good programs, for the most part, but they simply cannot keep up with the need for trained persons. Under present rates of preparation of Master's level teachers of the emotionally disturbed, for example, allowing for attrition, population growth, etc., it would take 800 years to produce enough teachers to man special classes for all emotionally disturbed children (Gallagher, 1970).

Almost every contemporary publication related to the education of young children includes a prediction of increasing attention to, and expansion of, early childhood education programs in the years to come (McLure and Pence, 1970). Factors frequently cited in support of this prediction are: 1) a new dynamic

view of intelligence; 2) the "discovery" of disadvantaged children as part of the Federal government's "War on Poverty" programs; and 3) the conclusion that compensatory programing beginning at the usual age of 5 or 6 for entrance into the public school system is too late to effect changes in children's cognitive development (Anderson and Shane, 1971; Evans, 1971; Frost, 1973; Gordon, 1972). Finally, and perhaps most compelling, legal action and litigation in 26 states have resulted in court mandates or legislation requiring appropriate education for all handicapped children. The minimum age level varies from birth in some states up to the customary beginning school age of six.

There will be an ever-increasing demand for prepared professionals and paraprofessionals in the field of early childhood education. The Educational Policies Commission is on record as advocating, "All children should have the opportunity to go to school at public expense beginning at the age of four." (Educational Policies Commission, Universal Opportunity for Early Childhood Education, 1966). The Office of Child Development of the Department of Health, Education, and Welfare has declared a major thrust in improving the nation's day care services in the 1970's. As early childhood programs increase, as is expected, a vast cadre of educators and paraprofessionals skilled in dealing with the pre-primary level children will be needed. Present methods of training will be inadequate to meet the needs.

Obviously, alternative training approaches are needed to supply sufficient personnel who can provide adequate educational services to preschool and elementary school children. Two alternate approaches which may be helpful are 1) training preschool teachers and child care workers to deal effectively with children in day care centers and other pre-primary programs; and, 2) training regular classroom teachers to teach handicapped children in the regular classroom. Through the first approach, teachers would provide individualized instruction in order to prevent the development of serious learning problems in children. Through the second approach, teachers would provide individualized instruction aimed at ameliorating existing and incipient learning problems early in a child's school experience.

Under grant and contract support from the Bureau of Education for the Handicapped, Office of Education, a team of researchers and curriculum development specialists at Penn State has developed a series of computer-assisted

instruction (CAI) courses in special education to prepare preservice and inservice teachers to identify and deal effectively with conditions in children which may adversely affect their school performance.

Called CARE (Computer Assisted Remedial Education), the series of courses is made up of completely self-contained, college-level, computer-assisted instruction courses designed to promote clinical sensitivity on the part of regular classroom teachers and to develop in them a diagnostic awareness and understanding of the strengths and weaknesses of handicapped and normal children.

CARE is principally oriented toward preschool, and primary level teachers because, as specialists point out, unrecognized problems and resulting lack of remedial treatment at this stage in a child's development may cause the child to be academically retarded by the time he is 9 or 10 years old. However, the courses have been designed so that they are also of interest to other educational personnel such as secondary teachers, principals, supervisors and other administrators; special class supervisors; school nurses, psychologists, aides; special services personnel, and other school-related personnel, including day care workers. The curriculum and philosophy have been described in detail elsewhere (Cartwright, Cartwright, and Robine, 1972; Cartwright and Cartwright, 1972a; Cartwright and Cartwright, 1972b; Cartwright, Cartwright, and Ysseldyke, 1973; and Cartwright and Cartwright, 1973. See Appendix A for selected reprints.)

CARE courses are made available to CAI centers with compatible equipment for the cost of computer tapes and other supplies. One or more CARE courses are currently being used by the following CAI centers: Penn State Computer Assisted Instruction Laboratory, University Park, Pennsylvania; University of Texas at Austin; State University of New York, Stony Brook; University of Alberta, Edmonton, Alberta; National Technical Institute for the Deaf, Rochester, New York; and Montgomery County Public Schools, Maryland. For the past three years the Bureau of Educational Personnel Development has supported a unique dissemination program. The program has been successful in reaching some 2,500 educators by means of mobile computer assisted instruction systems. (See Appendix B for reprints describing this delivery system.)

Purpose of this project. This project developed two computer assisted instruction courses to enable preschool and primary level teachers to work more effectively with handicapped children. The two courses are called CARE 2, Diagnostic Teaching of Preschool Children, and CARE 3, Diagnostic Teaching of Primary Children. The courses are related to and fit into a sequence of CARE courses. The series of CARE courses is designed to help fill the need for trained persons to work with and teach young, normal and mildly handicapped children.

CARE 2 was developed for teachers, child care workers, teacher aides, and other persons who are concerned with the affective and cognitive development of children who attend pre-primary programs in a variety of preschool settings. CARE 3 was designed to provide training in the Diagnostic Teaching Model for teachers and other educational personnel who are concerned with the education of children in the kindergarten-primary age range (grades K-3).

Target Group

The courses are appropriate for teachers of children in the age range of preschool through grade three. Specifically, the courses are designed to assist teachers and aides in the education of mildly handicapped children in the regular classroom. Both courses are suitable for teacher aides or day care workers who are alert and are of reasonable intelligence but who, for one reason or another, have not had the opportunity to obtain college training. In addition to being designed for inservice teachers and aides, the courses are also designed to be used by preservice teachers who plan to work with handicapped children in either regular or special classes.

Dissemination

Results of this project will be made available to practitioners in one of five ways. 1) Penn State resident instruction laboratory. It is anticipated that approximately 600 students per year will take either CARE 2 or CARE 3 at Penn State's Computer Assisted Instruction Laboratory. 2) Penn State's mobile computer assisted instruction laboratories. Approximately 1,000 persons per year will take the courses in locations away from University Park campus by means of the two mobile computer assisted instruction laboratories managed by Penn State. These laboratories will not be restricted to locations within

the Commonwealth of Pennsylvania. 3) Other institutions with compatible computer equipment have offered the CARE 1 course (Early Identification of Handicapped Children) and have expressed interest in obtaining the CARE 2 and CARE 3 courses. 4) The CARE 2/3 handbook (531 pages) and the CARE 2/3 syllabus (145 pages) are available for dissemination to persons who wish to use the major concepts developed in the course development project (descriptive materials have been prepared and are also available for dissemination.) 5) A tape containing the entire content of the CARE 2/3 courses including all computer programing, all content, and all instructional strategies is held in storage at The Pennsylvania State University Computer Assisted Laboratory. Persons who are interested in obtaining the entire contents of the tape may do so. This tape is maintained in up-to-date form in the event that other persons or institutions may wish to translate all or part of the CARE 1 program into another computer system.

CHAPTER TWO

COURSE DESCRIPTION

Purpose

Two highly related courses were developed on this project. These courses are called CARE 2 -- Diagnostic Teaching of Preschool Children; and CARE 3 -- Diagnostic Teaching of Primary Level Children. Both courses were developed for administration by computer assisted instruction, specifically on the IBM 1500 instructional system.

As was indicated in the previous chapter, the courses were developed for use with inservice teachers, day care workers, and aides, as well as for preservice teachers who are in training to become instructors in regular or special classes.

The major goal of both courses is to teach regular, elementary and preschool preservice and inservice teachers how to work effectively with children who have learning problems because of mild handicapping conditions. The teaching of children who have vision, hearing, or physical impairments is not covered in these courses. Upon completion of either of the courses, teachers will have achieved the objectives listed in Table 1. These objectives are directly correlated with the decision process flowchart appearing in Figure 1. The objectives and the flowchart together are termed the Diagnostic Teaching Model. This model is a generalized prescriptive or clinical teaching model and is the heart of the courses. All content and strategies throughout the courses are directly related to the various steps and philosophy outlined in the model.

This section of the Final Report merely presents an overview of the content of the Diagnostic Teaching Model and the CARE 2/3 courses. Further delineation of the course content is in Vol. 3, Syllabus.

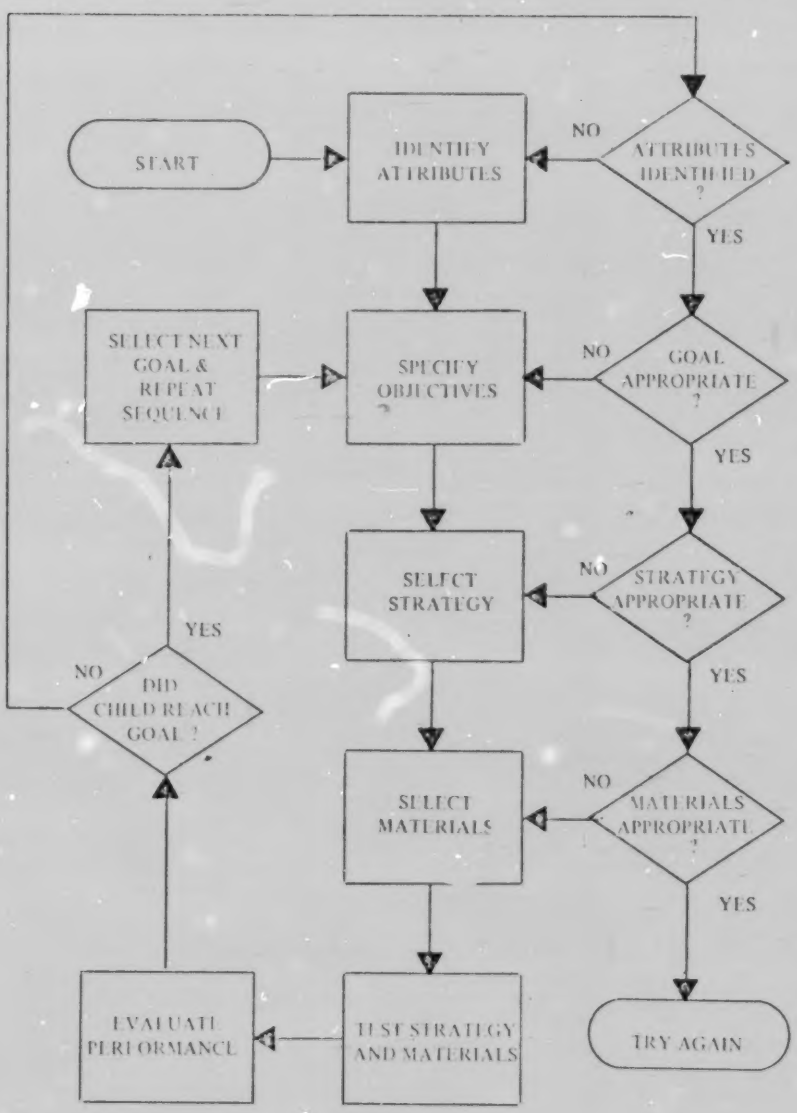


Figure 1. CARE 2/3 Diagnostic Teaching Model Flowchart.

Table 1
Major Objectives of CARE 2/3

Persons who complete CARE 2 or 3 should be able to:

A. Identify characteristics of individual children that indicate special teaching or management procedures are required.
B. Specify relevant educational objectives for individual children.
C. Select techniques for effective classroom management.
D. Choose and use specialized teaching strategies for reaching specific objectives for children with varying behavioral and learning characteristics.
E. Choose and use special materials in association with specific strategies.
F. Identify and use appropriate evaluation procedures.
G. Draw upon existing sources of information regarding specialized strategies and materials.
H. Consult with available resource persons for assistance.

Relationships Between Objectives and Decision Process

This project produced two courses which are quite pragmatic in their orientations. The courses used as a unifying theme the CARE 2/3 Diagnostic Teaching Model. All content and strategies selected for inclusion in the course were related to the Diagnostic Teaching Model.

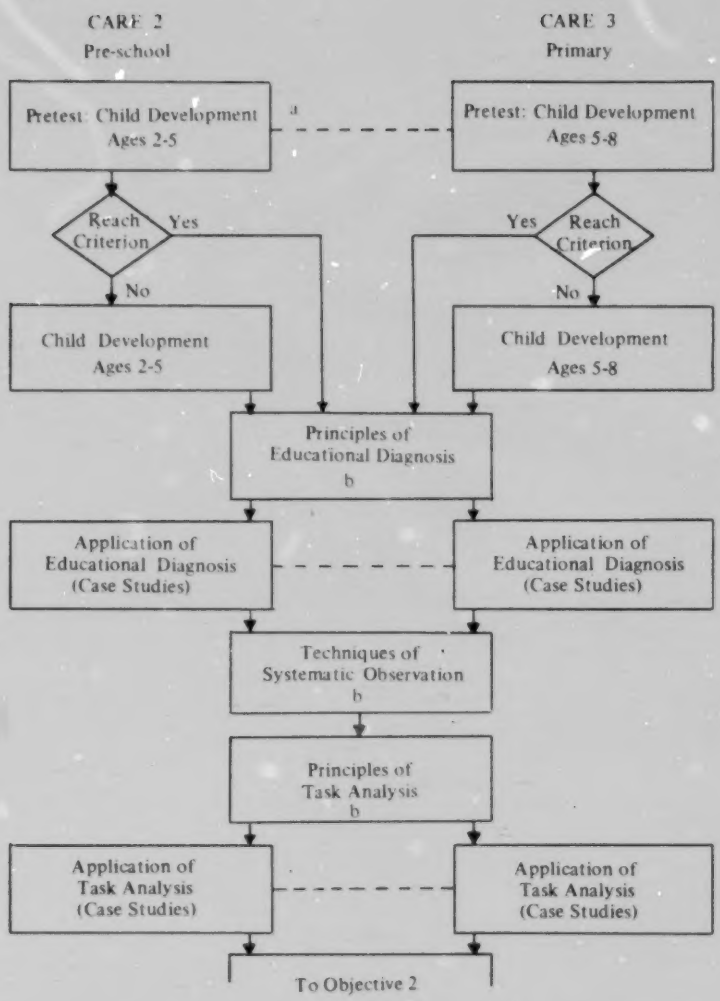
A modular approach was used in the development of the courses. The two courses contain certain information, procedures, and strategies which are common to both courses. In the instances where common material was required, an author prepared a single chapter which was then slightly modified to meet the needs of the varying age groups. Both within the chapters and in other locations in the course, specific applications to different age groups are made. A conceptualization of the modular approach is given in Figure 2. For example, part of each course was directed toward having teachers become familiar with some of the broad

management strategies that are embodied in the behavior modification approach. The principles presented are the same for both CARE 2 and CARE 3. However, the examples and the simulated case studies in which students apply the principles are different for the two courses. In CARE 2, students are given practice with case studies dealing with children ages 2-5; similarly, CARE 3 students are given examples dealing with children in the primary grades. There are, of course, areas in which such commonality does not exist. In those instances, separate chapters were developed or a special chapter related to one age group was developed. (For example, Reading for CARE 3; Day Care Theory and Application for CARE 2.)

The courses are divided into ten modules. With the exception of the first module which is introductory, each of the modules is accompanied by a pretest and a posttest. The pretest permits a student to test out of one or more of the portions of the module. The modules are divided into one to five chapters. Each chapter is further divided into smaller sections. Finally, each of the sections has one or more specific objectives related to it. The structure of the course is shown in the Syllabus, which is in Volume 3 of this report. The Syllabus also contains the specific objectives and content outline.

There is a strong relationship between the ten parts or modules of the courses and the eight major course objectives. The titles of the modules and the 31 chapters are in Tables 2 and 3.

As is illustrated in Figure 2, CARE 2 and CARE 3 have chapters covering the same general content. However, there are separate application sections for each course. The application sections for CARE 2 deal with children ages 2 to 5; CARE 3 covers children ages 5 to 8.



[a] Dashed line indicates that the same format is used for both courses; teaching strategy (and programing) are the same but content differs.

[b] Basic content and strategies are the same for both.

Figure 2. Relationship Between CARE 2 and CARE 3 Modules.

Table 2

CARE 2: Diagnostic Teaching of Preschool Children

Chapter	Title
Part I - Introduction	
1	Introduction to CARE 2/3
2	Summary of CARE 1
3	Diagnostic Teaching Model*
Part II - Child Development	
4	Important Concepts of Child Development
5	Motor Development - Infancy to Age 5
6	Intellectual Development - Infancy to Age 5
7	Social-Emotional Development - Infancy to Age 5
8	Language Development - Infancy to Age 5
Part III - Identifying Relevant Characteristics of Children	
9	Important Concepts About Educational Evaluation
10	Important Concepts About Educational Diagnosis
11	Systematic Observation
Part IV - Specification of Goals and Objectives	
12	Formulating Instructional Objectives
13	Task Analysis
Part V - Instructional Procedures	
14	Factors to be Considered in Planning Instruction
15	Behavior Modification
16	Open Education
17	Comparison of Open Education and Behavior Modification
Part VI - Selection & Retrieval of Instructional Procedures and Materials	
18	National Network of Instructional Materials and Regional Media Centers
19	Computer-Based Resource Units
20	Prescriptive Materials Retrieval System
21	Fountain Valley Teacher Support System (Optional)

*Beginning with this chapter there is a differentiation between CARE 2 and CARE 3. Although the same general concepts are taught in chapters common to CARE 2 and CARE 3, applications and examples are tailored to the age groups addressed in each course.

Table 2 - Continued

Chapter	Title
Part VII - Application of the Diagnostic Teaching Model	
22	Language Development
23	Reading (Optional)
24	Mathematics
25	Social-Emotional Development
26	Motor Development
Part VIII - Resources	
27	Using Resource Persons: Roles, Referral Statements and Follow-Up
28	Parent Education
Part IX - Day Care	
29	Day Care Theory
30	Day Care - Application
Part X - Summary	
31	Summary of CARE 2

Table 3

CARE 3: Diagnostic Teaching of Primary Children

Chapter	Title
Part I - Introduction	
1	Introduction to CARE 2/3
2	Summary of CARE 1
3	Diagnostic Teaching Model*
Part II - Child Development	
4	Important Concepts of Child Development
5	Motor Development - Ages 5 - 8
6	Intellectual Development - Ages 5 - 8
7	Social-Emotional Development - Ages 5 - 8
8	Language Development - Ages 0 - 5 (Optional)
Part III - Identifying Relevant Characteristics of Children	
9	Important Concepts About Educational Evaluation
10	Important Concepts About Educational Diagnosis
11	Systematic Observation
Part IV - Specification of Goals and Objectives	
12	Formulating Instructional Objectives
13	Task Analysis
Part V - Instructional Procedures	
14	Factors to be Considered in Planning Instruction
15	Behavior Modification
16	Open Education
17	Comparison of Open Education and Behavior Modification
Part VI - Selection & Retrieval of Instructional Procedures and Materials	
18	National Network of Instructional Materials and Regional Media Centers
19	Computer-Based Resource Units
20	Prescriptive Materials Retrieval System
21	Fountain Valley Teacher Support System

*Beginning with this chapter there is a differentiation between CARE 2 and CARE 3. Although the same general concepts are taught in chapters common to CARE 2 and CARE 3, applications and examples are tailored to the age groups addressed in each course.

Table 3 - Continued

Chapter	Title
Part VII - Application of the Diagnostic Teaching Model	
22	Language Development
23	Reading
24	Mathematics
25	Social-Emotional Development
26	Motor Development
Part VIII - Resources	
27	Using Resource Persons: Roles, Referral Statements and Follow-Up
28	Parent Education
Part IX - Day Care	
29	Day Care Theory (Optional)
30	Day Care - Application (Optional)
Part X - Summary	
31	Summary of CARE 3

Objective A. In large measure, the competency for the first objective (A) and the first step of the Diagnostic Teaching Model involve a recapitulation of the competencies and content of the Identification Model (CARE 1). The focus is on enabling the teacher to determine specific educational needs and relevant characteristics for individual learners. Many of the generalizations and data collection techniques used with the Identification Model are applicable to objective A. Chapters related to this objective are Chapters 2, 4, 5, 6, 7, 8, and 13.

The selection, administration, and interpretation of published diagnostic tests and procedures for designing, using, and interpreting teacher-constructed diagnostic tests are involved in objective A. General principles related to this topic are taught in Chapters 3, 9, 10, and 14. Specific tests and procedures are taught in Chapters 21-25. In many instances, however, a formal diagnostic procedure will not yield adequate information about a learner. Therefore, teachers need to have competency in the general area of observation skills. Teachers should be able to set up the environment as a "test" for certain observable behavioral outcomes, determine which observable behaviors will be recorded, and design records for collecting observational data. Information on this topic is presented in Chapters 11 and 13.

Objective B. After specific needs and relevant characteristics for an individual learner have been determined, the teacher should be ready to move the child forward by specifying appropriate objectives for the child. This is the competency for objective B and the second step in the model. Chapter 12 is devoted to this topic. A knowledge of the child's competencies (gained from objective A) should be involved in determining which target behaviors are appropriate for a child. The teacher should be able to formulate objectives in terms of observable behaviors to be displayed by the learner, the conditions under which the behavior is to be exhibited, and the criteria for an acceptable performance. In order to formulate appropriate objectives, teachers should be able to perform task analyses of several broad areas including academic, social-emotional, and motor areas. Successful completion of Chapter 13 should give the teacher the competency to delimit and sequence specific behavioral objectives.

Objective C. For successful implementation of the third level (and objective C) of the Diagnostic Teaching Model, the teacher needs to become aware of the range of instructional procedures available for effectively managing the educational problems of children. The principles of behavior modification (Chapter 15) should be especially useful for implementing this competency. In addition to behavior modification, other information which is related to objective C includes topics such as setting limits, developing routines, providing learning and behavioral models, and the physical arrangement (furniture, materials, storage, dividers, etc.) of the classroom, and techniques of communicating with young children to promote mental health. Information on these topics is presented in Chapters 14, 16, 17, 27-30.

Objectives D and E. Competencies for objectives D and E are concerned with the teacher's ability to select and use specialized teaching strategies and associated special materials (Chapters 18-26). In contrast, objective C concerns effective classroom management and involves general procedures which would be appropriate for use with a variety of problems (both learning and behavioral) and for learners with a variety of characteristics and needs.

Objectives C, D, and E, and the third, fourth, and fifth steps in the individualized teaching process, focus the teacher's attention on general and specific instructional procedures that might be employed to assist the child in the regular classroom in order to accomplish the educational objectives which have been described for him by the teacher.

All teachers have a sampling of specialized strategies and materials in their repertoires. It is probably not possible to expect comprehensive knowledge of published and teacher-developed strategies and materials. Rather, the emphasis should be on grasping the underlying principles involved in making a match between the unique characteristics and needs of the learner and the unique properties of the strategy and materials.

The fifth step in the model and the competency for objective E requires that the teacher select an appropriate instructional device, and, with a preferred instructional methodology, try out the prescription with a child on whom a diagnosis has been made. The teacher who satisfactorily attains the competencies for objectives A through E will be prepared to write a preventive or remedial prescription for individual children who evidence a wide range of existing or incipient educational problems. The teacher will be able to collect pertinent data, recognize when to

seek the advice of consultants and other resource people, generate pertinent educational objectives that are appropriate to various situations, evaluate which educational methodology seems appropriate for individual children, and consider the instructional devices that might be used to facilitate the accomplishment of the educational goals for individual children.

Objective F. The teacher competency associated with objective F and with the sixth step in the process, to identify and use appropriate evaluation procedures, is especially pertinent in view of the experimental nature of a diagnostic teaching situation. Since there is no formula one can apply in order to select a teaching strategy for a learner, any match between learner needs-characteristics and strategy-material is tentative and must be checked out on an empirical basis. For this reason, the published, and especially the teacher-constructed devices used for evaluation which yield immediate information about performance are emphasized. Interpretation of evaluative data and implications for changing strategy and materials and/or objectives derived from the evaluative data are stressed throughout the course.

Teachers should be able to decide upon the appropriateness of various evaluative techniques; make decisions concerning adjustments that need to be made in goals, methods, and/or materials, consider what additional resources and/or consultants might be helpful in deciding on an effective and efficient educational and management program; and review the steps that might be taken to organize school personnel and parents of the children. (Chapters 27-30).

Objectives G and H. Competencies for objectives G and H are highly related to those for objectives D and E. A great variety of strategies and materials for young children are currently being described and published by a variety of sources. It is incumbent upon the teacher to be aware of the available information since a teacher cannot be expected to develop new specialized and unique strategies and materials for all the children in the class. Therefore, the teacher should be expected to know the resources which are available concerning retrieval of instructional strategies and materials. There is a need for an awareness of the kind of descriptors required for information retrieval and a need to know what type of information can be expected from the retrieval system. That need is addressed in Chapters 18-21. Chapter 27 is directly related to objective H.

If the diagnostic teaching is successful, an affirmative response to the question, "Did child reach the goal?", will be forthcoming. The same sequence of behaviors is then followed again for the next objective for the child. If the child did not reach the goal, the model indicates the type of systematic analysis needed in order to determine which step in the diagnostic teaching sequence was in error. If an error is found to be associated with one of the steps in the process, the teacher simply cycles back and re-enters the system at the error point, corrects the original error, and continues again through the main sequence of diagnostic teaching behaviors.

Supplementary Materials

Textbook. A 531 page textbook (handbook) was written especially for CARE 2/3. Its title is Diagnostic Teaching of Preschool and Primary Children. The text was prepared from the manuscripts and objectives that authors used in developing their chapters. This textbook has two functions: 1) It is a guide for the student while he takes the course. Students are encouraged to read a given chapter in the textbook before they take the chapter by computer. Typically, students keep the textbook with them as they work with the CAI system. They page along in the textbook as they receive tutorial instruction by the computer and underscore important passages in the textbook. Furthermore, they use the margins and blank pages provided in the textbook for notes related to the course. Thus, the textbook becomes a very personal document for each of the participants. Upon conclusion of a module, the students use the textbook summaries to study for the 7 quizzes in the course. Also, the students use the textbook to study for the final examination. 2) Besides the detailed summaries of course content, the textbook includes reference materials, such as charts, tables, student cummulative records, examples of evaluation devices, definitions, and samples of key graphic material from the course. At the end of each chapter in the textbook there is an up-to-date list of content-related references.

A complete handbook is included in this final report as Volume 2.

Prescriptive Materials Retrieval System: Educational Descriptor Dictionary. Chapter 20 of CARE 2/3 is an explication of the Prescriptive Materials Retrieval System. Through the excellent cooperation of the Select-Ed Company, Olathe, Kansas, we were able to photograph various components of the prescriptive

Materials Retrieval System. Furthermore, the Company has made available quite a number of their Educational Descriptor Dictionaries to us free of charge to give to students who complete the CARE 2/3 courses. Thus, students will receive detailed instruction on how to use the Prescriptive Materials Retrieval System and will have an Educational Descriptor Dictionary to keep after they conclude their interaction with the CAI course of instruction.

Fountain Valley Teacher Support System (FVTSS). Richard L. Zweig, Associates, Huntington Beach, California, were kind enough to give us permission to reproduce parts of their Fountain Valley Teacher Support System in Reading. In Chapter 21 of CARE 2/3 is a detailed explanation of how to use this retrieval system. Special arrangements have been made with the Company to enable us to purchase copies of the FVTSS Teachers Manual. The Teachers Manual is used by the students as they learn about the system. The students then take the Teachers Manual with them after they conclude the course.

CHAPTER THREE

PHASES OF DEVELOPMENT

All of the activities undertaken during this project were devoted to the development of two computer-assisted instruction courses in the diagnostic teaching of preschool and primary children. In general, these activities were based on continuing improvements of procedures devised during the CARE 1 project. (See Cartwright and Mitzel, CARE 1 Final Report, 1971; Palmer, Shea and Cartwright, Course Planning Manual, 1971.) A summary of the various tasks and activities and the sequencing and phasing of the various activities is given in this Chapter.

Phase 1: Refinement of Course Description

The first six months of the project emphasized two main functions: recruitment of professional staff and refinement and extension of the course outline and course description.

Most of the technical staff (computer programers, systems analysts, graphic artists) were already on-hand and trained at the start of this project. The staff members were part of the semi-permanent staff of the Penn State Computer Assisted Instruction Laboratory. One additional computer programer was recruited, though, to fill out the staff and to assist in the computer programing. The major task was to recruit the professional staff who were experts in their fields of early childhood education or special education and were interested in the development of computer-assisted instructional materials. A national search was conducted beginning immediately upon formal notification of the funding of the project. When selections of professional staff were made, these persons were brought in as consultants prior to their actual employment as faculty at Penn State.

Immediately upon formal notification of the funding of the project, the principal investigators and graduate assistants began a formal and thorough search of the existing literature related to the topic of diagnostic teaching, early childhood education, and special education. A graduate student with several years experience as a bibliographer and information retrieval specialist at the Center for Applied Linguistics in Washington, D. C. was obtained to set up an information file and to manage a clearinghouse for incoming literature. The information system that was finally developed is reported in Appendix C.

Three main research techniques were used to scan the available literature related to diagnostic teaching of preschool and primary children. First, extensive use was made of the computer retrieval systems. One or more computer searches of the literature were made by each of the following services: Council for Exceptional Children Information Center, American Psychological Association (PASAR), and the ERIC system.

Second, a series of letters was sent to agencies and individuals known to be involved with diagnostic teaching and preschool programing for children. These persons or agencies were asked about their current activities related to the topic. This procedure of writing for information continued throughout the project. For the most part, the principal investigators were very pleased with the quick response and the helpful nature of the responses that were received from these inquiries. Almost all of the people contacted were willing to share their information about their activities. Finally, a standard library search was made using the facilities of The Pennsylvania State University library system. This library system is quite extensive and is on a par with major university facilities throughout the United States. During the course of the project, approximately 1,000 items were coded, abstracted, and filed in such a way that project authors could have ready access to the abstracts and documents.

The principal investigators and assistants reviewed the course framework and planned a flowchart in anticipation of the next step of specifying behavioral objectives. During this phase, wide review of the plans was obtained from colleagues, consultants, students, and quite a number of inservice teachers. Adjustments in the overall schema were made to reflect new information and opinions as they were obtained. During the first several months, specification of global objectives or overviews of the chapters to be included in the courses were developed. The major decisions made during this planning and refinement period were to identify by title and content the 31 chapters to be included in CARE 2 and the 31 chapters to be included in CARE 3. Grouping of related chapters into sections was made and related to the major components of the Diagnostic Teaching Model that was used as the framework for the course. The use of the Diagnostic Teaching Model was re-affirmed and thereafter during the project decisions related to course content were made after relating the questions to the Diagnostic Teaching Model.

Also during this phase, plans were developed for evaluation of student progress through the courses. A decision was made to develop pretests for seven of the ten sections of the course. The courses were developed in such a manner that students may pretest out of one or more chapters of the course. Parallel forms of the pretests are used for chapter and section quizzes, and other parallel forms are used for the final examination. All of these examinations are given by the computer. More detail on this topic is provided in a later section of this report.

Phase 2: Specifying Behavioral Objectives for the Courses

A major step in the course development procedures was the identification of specific behavioral objectives of the course. Overall objectives or goals for the courses were identified with the Diagnostic Teaching Model (see Chapter Two). The next major task was to break down these global objectives into enabling objectives and terminal objectives related to specific content or procedures. This step was carried out by the chapter authors. For each of the 62 chapters in the CARE 2 and CARE 3 courses, an author was identified as being responsible for that content. In practice, there was much duplication of concepts and objectives between correlary chapters of CARE 2 and CARE 3. Thus, there were 22 common chapters; these common chapters accounted for 44 of the total number of 62 chapters. The remaining 18 chapters were unique to CARE 2 or to CARE 3. Even within the so-called common chapters, however, differentiation was made between the CARE 2 and CARE 3 courses. Separate branches were used in the CARE 2 or CARE 3 versions of the chapters to relate that content to the target group of children. Also, separate branches were used to give specific examples of the concepts related to either preschool or primary level children. The greatest distinction between the two courses was the use of extensive case studies. In most cases where case studies were used, they were focused on either young preschool children or primary children.

Fourteen persons had primary responsibilities for the writing (hereafter writing of course material will be referred to as "authoring") of the course material. Each of the course authors was required to become intimately familiar with the Diagnostic Teaching Model and the major purposes of the CARE 2/3 project.

Numerous conferences among the authors and the principal investigators were held. These conferences were carried out throughout the duration of the project. Given the course description, the Diagnostic Teaching Model, and auxillary information, the authors were requested to turn in a set of specific behavioral objectives appropriate for the chapter they were to write. To obtain these specific behavioral objectives, the authors used the information system developed by the investigators and used their own personal information gathering devices. This step resulted in additional expansion of the information system.

All objectives were reviewed by the investigators and approved before the authors continued to work on the chapters. In practice, this phase did not work as smoothly as we would have liked. Our experiences and conversations with other persons enagaged in instructional product development reveal that authors have different styles of working. Some persons find it impossible to develop a good instructional product without specifying objectives in advance. Other persons seem to carry implicit objectives in their heads but are able to state them explicitly only when they have done some writing of the materials. At any rate, this phase produced some wide variability of objectives and some variable quality. However, for those few authors who had difficulty with the delineation of multiple objectives, the investigators permitted them to continue in the course writing after having ascertained that the authors did have a firm knowledge of the content to be covered. The principal investigators were most explicit in insisting that the content be directly related to the Diagnostic Teaching Model and that authors not fall into the trap of preparing interesting but extraneous material.

Phase 3: Writing Course Material

After Phase 1 was completed and Phase 2 was well underway, the authors began writing the course material. The course material was directly related to the objectives specified in Phase 2. The purpose of the course material is to help the intended learner achieve the level of performance required for satisfactory completion of terminal responses associated with the objectives.

After a given author was comfortable with his objectives or his plan for developing content in a given chapter, he began writing course material. Two major "rules" were to be followed by the authors in developing course material. First, only information directly related to the Diagnostic Teaching Model would be

included in a chapter. Past experience has shown that many neophyte authors have a tendency to prepare material which is easy for them to write or which they know well. Unfortunately, however, oftentimes the material prepared by the beginning authors is only tangentially related to the central objective of a particular segment. The other "rule" for authors was to provide extensive interaction between the computer system and the learner; i.e., it was regarded as essential for the learner to be forced to respond to questions very often. This active participation by the learner, it was felt, would help in the learning process by requiring the student to be an active rather than a passive learner. Also, immediate feedback for the learners on questions both during the course material and the quizzes has proved to be extremely motivating as well as a useful learning device. Finally, continuous checking of student's knowledge and understanding enables the system to branch the student to review sections if it becomes apparent that the student is not answering questions in the correct manner. A correlary to rules for writing CAI material was the use of realistic situations and many examples of the content.

Each author was asked to produce a flowchart of the content of the chapter prior to his actual writing of the narrative. This flowchart was checked with the principal investigators during this phase of the course development. When the flowcharting was considered to be adequate, authors began actually writing the narrative and interactions for the CAI material. Again, numerous conferences were held between the principal investigators and the various authors. The principal investigators reviewed each sentence and paragraph for each frame of the draft material. Numerous corrections and revisions were made as a result of these reviews. Many chapters were drafted and revised several times before the material was considered a satisfactory draft. It was only after this paper review that the course material was given to programers for translation into the computer language.

In the principal investigators' opinions, these two phases of activity were probably the most important phases in course development. Experience with other CAI programs and other installations has seemed to minimize the importance of this activity of course review and revision prior to submission to programers. The investigators took the position that the authors were professional persons, knew their content well, but needed a second or third set of eyes to review their material. It is easy to get too close to this kind of material and to overlook weaknesses or omissions.

In this phase it was found that there was a wide variety of author styles. Many of the authors found it quite frustrating to prepare CAI material. There were two "drop outs" and other authors never really did get to the point where they could prepare satisfactory material. In those instances, other authors were obtained to finish the job, or in most cases, the principal investigators revised or wrote the material. This phase was frustrating for the investigators as well as many of the authors. Preparation of CAI course material seems to take a particular attitude and aptitude which is difficult to define. One component of successful authors seemed to be the willingness to spend a great deal of time working on each sentence and each frame. Some of the authors, although willing to put in time in the research for the material, found it difficult to put in this laborious effort in the writing. Such effort is essential for the success of the CAI program because of the extensive and highly focused scrutiny that each word and each frame of the course material receives from the students. The misuse of a single word can, of course, mislead the students substantially. Writing each frame in an interactive CAI system is akin to producing standardized test questions. Each word or sentence must be clear and unambiguous. In those many frames which require student response, anticipated student responses must be anticipated by the authors and extensive and appropriate feedback must be given to the student responses.

Another component which seems to be related to the success of CAI writing is the intangible aptitude of creativity. Some authors seem to be able to come up with unique and interesting ways to present the material. Others find it difficult to get out of the lecture mode. In essence, successful CAI writing seems to have the same characteristics as successful teaching: highly motivating and creative presentations undergirded by extensive preparation related to the course content.

Without a doubt, the most successful writers of the CAI course materials were the female graduate students used on the project. This is not meant to imply that the faculty involved in the project were not contributors; on the contrary, each of the faculty participants engaged in course development and evaluation in other ways. However, the female graduate students were the most productive and the most creative of those persons involved in writing. It is hypothesized by the investigators that faculty members have a greater set of pressures which prevents them from spending long periods of uninterrupted time working with the course writing. They are responsible to their students and must be available much of the time for other duties.

Experiences with this phase, and the first two phases of the course development, prompts us to make a recommendation for further course development. The most successful writers and participants in the project were those who were connected with the project for a long period of time for a high proportion of their time. It is recommended therefore that further course development be staffed with a few full time persons rather than with a great number of part time persons.

In summary, course materials and instructional strategies were planned and written to take full advantage of the unique capabilities of the CAI system. These capabilities provide for instruction in different media, but more important, also provide the means by which individualization of instruction can be achieved. Thus, the authors were able to provide for different amounts of prior knowledge of course concepts as well as different styles of learning and rates of progress.

Phase 4: Preparation of Course Material for the CAI System

In addition to the problems of providing accurate course content and challenging presentation, CAI authors must be concerned about the format of their drafted material. Course materials must be prepared in such a way that computer programers can understand the various requirements of a particular author and know when and where to show various images or to play audio messages. Just as the principal investigators reviewed course material for content, accuracy, and mode of presentation, they also reviewed the author's drafted material for basic style. The authors had been instructed in a special author language called TACL. TACL is more fully explained in Appendix D, but essentially TACL is an easy course authoring system. This TACL language was developed at The Pennsylvania State University and the CARE courses were the first to be programed in this language. The TACL authoring system has saved considerable time over previous methods of programing for computer-assisted instruction.

Turn around time for an author's drafted material and its presentation on line varies according to the accuracy of the author's initial writing and the extensiveness of the branching and answer processing required. With simple material, it is possible for an author to review his chapter on-line the next day. In practice, there was a delay of several days before the basic material was ready. It was possible to program the cathode ray tube (CRT) to display

information immediately, but the CRT was only one of several components used by the CAI system. Major delays were encountered in preparation of images, photographing of those images, and sending them out to be incorporated into an addressible image reel. Approximately six weeks was allowed from the time images were photographed and an addressed image reel was returned from the processing plant.

In general, the PERT planning outlined in the original proposal for this project was carried out for this phase of the project. That generalized PERT framework was first reported in an earlier publication by Palmer, Shea and Cartwright (1971).

Phase 5: Testing and Revising of the Course

During the developmental phases of this project, testing of course material and revision of such material occurred continuously. Major and minor adjustments of content and sequencing of objectives occurred prior to the time that any course material was programed for the computer. The major conceptualization and rethinking of the course material occurred during the early phases of the project and prior to the time that any material was committed to a CAI language. The investigators spent a great deal of time reviewing and revising authored material before it was given to the programers.

Additional "debugging" and revision often occurred as the programers worked with the material. As the programers began to convert the author's drafted materials into the TACL language, in numerous instances it was necessary for them to make adjustments in the flow of the course or to make adjustments in the presentation suggested by the author. In no case, however, did programers make decisions which could affect pedagogy without clearing the proposed change with the principal investigators.

As soon as sufficient course material of a given chapter was on-line and viewable, the author of that particular segment reviewed the material. The materials were reviewed prior to the time that images were photographed, and prior to the time that audio messages were recorded. At this point in time it was, therefore, quite easy to make radical changes in course flow or presentation. At this stage in the curriculum development procedure, the principal investigators

also reviewed all course material as it was brought up on-line. Numerous clerical people were recruited to review the chapters to help eliminate spelling errors, incorrect loops, and other minor "bugs".

To maximize the benefit of review by authors, programers, investigators, and later, field-test students, two systems for recording and revising errors were devised. First, a routine is built into all the CAI course material which permits students or authors to immediately comment on any aspect of the course. The student merely presses a button which places the system into a particular mode called the Comment Routine. This routine permits a student to type a comment related to that which he has just seen or to the course in general. The information is then stored on tape for later retrieval and analysis. Related to this, at all times when a student is interacting with the course material during developmental phases, every response that the student makes is recorded on tape. Then, a frequency analysis program is used to combine data from students. At a later time, the investigators reviewed the performance of the students by studying the frequency analysis print-out and the actual responses made by the students to each of the questions in the course.

The second system for recording errors was a simple card system. Each student or author or programer who took a course segment, no matter how short, was encouraged to have a supply of the cards on hand. If an error or a problem were encountered or if the student merely wanted to comment about the general nature of that particular segment, he recorded his reaction on the 5 x 8 cards. These cards were then arranged in the correct label sequence within segments after being divided according to "concept" revisions and "program" revisions. Program revisions went immediately to the programers. Concept or content revisions were reviewed first by the author or principal investigators and then were passed on to the programers with corrective action noted. The investigators also compared those card comments with student records. The card comments plus the information from the student records (type of error, number of errors, and similar kinds of information) were analyzed by the investigators and programers to pinpoint problems in content, pedagogy, and programing. When all such revisions were collected the programers revised the course segments chapter by chapter.

When the investigators were confident that the courses were running fairly smoothly, the first group of trial students took the courses. Complete performance records were kept on each of these students, and each student was strongly

encouraged to use the Comment Routine and the card system to point out errors in logic, content or sequencing. The students were interviewed by the investigators and some of the authors as they worked their way through the courses.

As the data from the students became available the principal investigators, authors, and programers used the data to revise and improve the courses. Literally thousands of revisions were made based on data collected during the various student tryouts.

Similar procedures were used for student tryouts and field tests in Bloomington, Indiana; Edwardsville, Illinois; Carbondale, Illinois, and University Park, Pennsylvania. Further details on this phase of evaluation is in Chapter Four of this report.

CHAPTER FOUR

EVALUATION

Evaluation was viewed in the contemporary context of instructional project development; i.e., once the decision was made to develop the CARE 2/3 materials for presentation by computer-assisted instruction, the project staff activities were devoted to making the CAI courses as powerful as possible. Project activities were designed to elicit a multitude and variety of relevant data from numerous sources. These data were gathered with the intent of improving the course by means of a cyclical formative evaluation process.

It is the attitude of the principal investigators that students who take a CAI course (specifically CARE 1-4) shall exhibit significant increases in knowledge of the subject matter as a result of taking the course. Furthermore, and more important, if students do not exhibit an increase in knowledge it is not the fault of the student but is the fault of the course. Thus, an evaluation of student knowledge as a result of taking the course is, in effect, an evaluation of the success of the course.

This chapter deals with the three major evaluative modes that were employed in the CARE 2/3 course development project: evaluation of students, evaluation by students, and professional consultation.

Evaluation of Students

Development of examinations. Early in CARE 2/3 planning, it was decided that the examinations should be criterion referenced in terms of the behavioral objectives for each chapter. However, because of the sheer scope of the courses and the tremendous number of objectives, it was not practical to test each objective. For example, the chapter on behavior modification contains over 130 objectives. Allowing a conservative estimate of 30 seconds per student response, more than two hours would be required to test only that chapter. Early estimates on testing time for all objectives indicated that about as much time would be required to take all examinations as would be required by the average student to complete the course. While such extensive testing was technically possible, it was not deemed desirable. Once it was established that all objectives could not reasonably be tested, it was decided that: 1) only major objectives would be

tested, and 2) only as much testing as was required to branch reliably or evaluate students would be undertaken before the final examination, 3) the final examination would require less than two hours to complete. With these constraints and goals, examination development followed the general sequence outlined in Figure 3.

Obtaining chapter objectives. Examination development actually began approximately 6 months into the project. By the time the evaluation procedures were finalized, some chapters were completed and the authors had left campus; other chapters were underway while still others had only been outlined. As a result, different procedures were followed in obtaining course objectives. When the authors were on campus, they were requested to submit chapter objectives and, if possible, three questions for each objective. When authors of completed chapters were not available, and chapter objectives were not available, project staff reviewed the chapter outlines and on-line content to determine the major objectives after the fact. Eventually, approximately 225 major objectives for each course were obtained.

Generation of item pool. Test items were obtained directly from authors and from project staff assigned to test development. The generation of three test questions per objective resulted in more than 1,200 items.

The same general procedure was followed in the development of each item. After the item was generated, it was reviewed by at least two project staff members to make sure the following criteria were met:

1) the item tested the objective;
2) the item was clearly written;
3) for fill-in items, unless the objective was to teach specialized vocabulary, specialized vocabulary was not required (alternative correct answers were then specified);
4) there was only one correct response for multiple choice items.

Field test I. In the spring of 1973, approximately 100 volunteer undergraduates enrolled in CARE 1 took a paper-and-pencil version of the examinations*. Approximately 35 students answered each question. This field test provided

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*This field test did not include approximately 10 chapters which had not been completed.

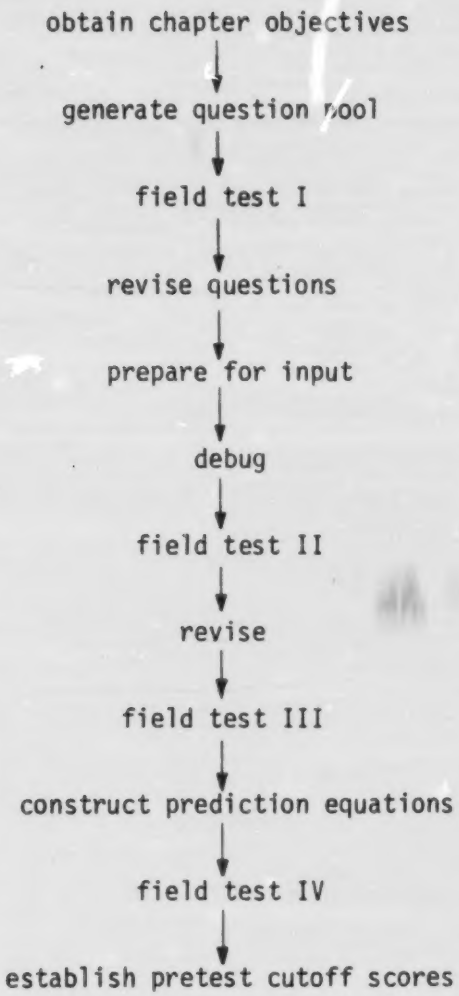

Figure 3. Test Development Sequence.

an estimate of item difficulty and distractor effectiveness with a group of subjects thought to fall in the middle of the target population. It was hypothesized that they would be more sophisticated than teacher aides without formal training but less knowledgeable than persons completing the course.

Revision. Based upon the results of the field test, approximately one-third of the items were revised to some extent. The majority of revisions were concerned with ineffective distractors.

Input. Input was begun after the field tested questions were revised. In addition, questions from newly completed chapters were included. During this phase, content revisions were considered to bring the examinations again into agreement with revised course content. Finally, the proportion of key positions on multiple choice items were balanced within chapters so that there would be approximately as many "a" responses as "b" responses, etc., correct. Questions for each objective (by chapter) were randomly assigned to one of three forms for the examination. Since chapters were grouped into sections and followed by a quiz, there were three pools of items for each quiz. When students reach Quiz I, they are randomly assigned to one of the three forms. On all subsequent quizzes, they receive the same form. Within each form and quiz, items are randomized. Each subject takes all items in his form, but his/her particular test has a unique sequence of items. This procedure minimizes the possibility of cheating. For example, Quiz I contains 34 items on each of the three forms. Assuming that all students begin Quiz I at the same time (a most unlikely occurrence, hence the most conservative estimate), the chances are 2 in 9 that adjacent students would obtain the same form. However, should they receive the same form, the probability of them having the same item at the same time is less than 1 chance in approximately 1,000. The probability of them having both the same form and same question at the same time is less than 1 in 5,000.

The final examination consists of 75 questions from one of the remaining two forms which the student has not seen. The final exam is a proportional (.33) sample of questions.

Debugging. As a final check, on-line questions were compared with coding sheets for completeness, correct spelling, correct keys, etc. As a final check on the content validity, test questions were cross referenced to the frames on which the questions were based.

Field test II. Twenty-eight students at Carbondale, Illinois, took the quizzes as chapter posttests. Data from these students were used to further revise the questions and eliminate misleading questions. The students were quick to point out what they considered to be inaccuracies or iniquities.

Field test III. A field test was conducted in early January, 1974, with a second group of relatively naive subjects and relatively sophisticated subjects. Data from this field test were combined with data generated by students completing the course to generate prediction equations for branching purposes. Final reliability estimates for both parallel forms and internal consistency were generated.

Field test IV. During January and February, 1974, 150 students in Springfield, Illinois, and University Park, Pennsylvania will take all the revised quizzes as chapter posttests. Also, approximately 130 students will take the quizzes as part of their courses during March and April, 1974. Data from these groups will be used to set criterion levels for pretest success. Beginning in June, 1974, all students will have the option of taking pretests for most of the chapters in the courses. Passing the pretests will permit students to skip to other chapters. The schema for this procedure in flowchart form is shown in Figure 4.

Evaluation By Students

One crucial aspect of any development project is the consumer's attitude toward the product. Several methods are currently available for evaluating the learner's attitude toward any course: spontaneous comments, open-ended questionnaires, questionnaires developed for the particular course, and general course attitude questionnaires. Each offers somewhat different advantages. Basically, student attitude responses can be used for: overall generalized course evaluation and refinement of specific sections or sub-sections of the course. Student attitude was used to obtain information on both of these purposes in CARE 2/3.

Comment routine. Earlier, it was indicated that a computer sub-routine for allowing students to make comments directly to the computer system is used as a part of all courses. Students are able to push a button and type in a comment related to how they feel about the frame or chapter in which they are currently engaged in study. The exact response along with the location in the course to which the response was made is stored on the computer tape for later analysis.

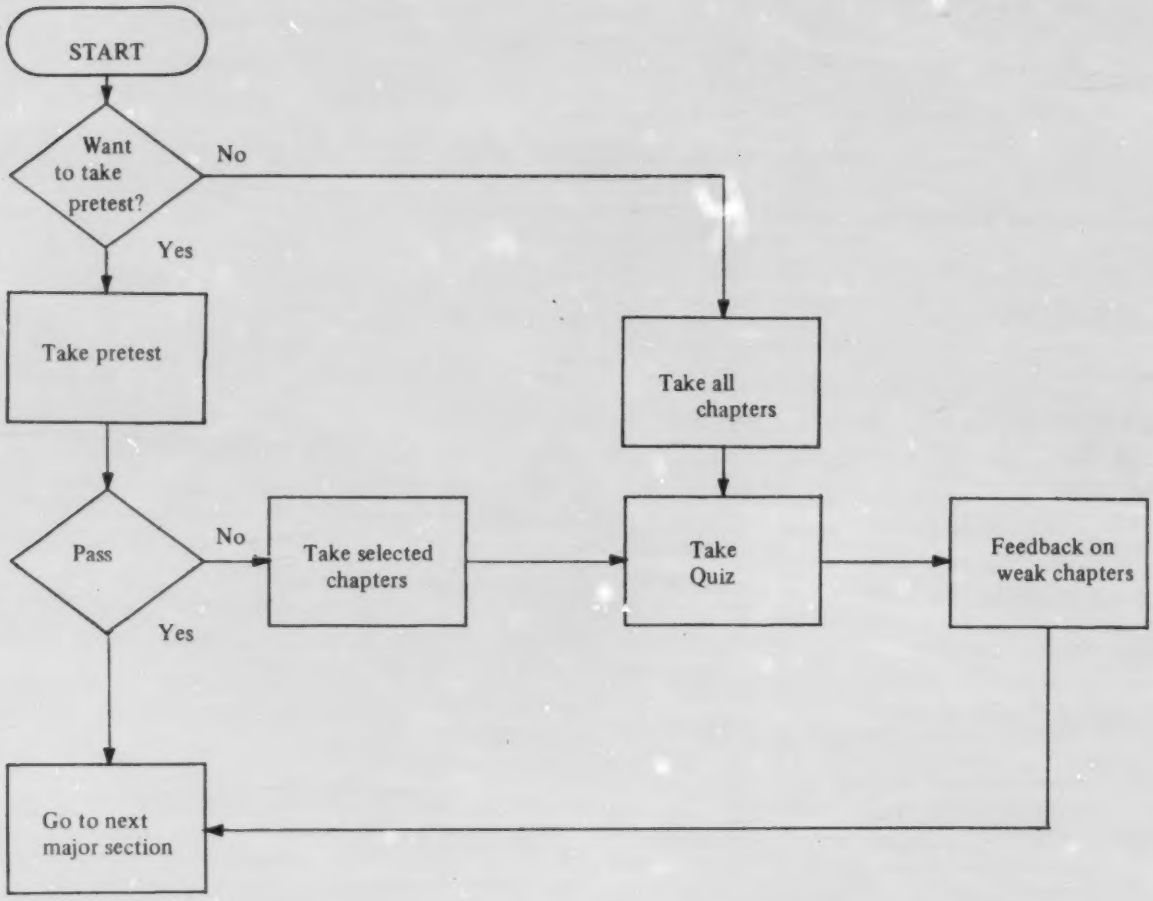

Figure 4. Section Quiz Evaluation Plan.

This routine has proved quite successful for several reasons. First, it enables the student to comment at the time at which he is pleased or displeased. (A paper and pencil format might be used for this purpose but students much prefer to type directly into the system which is providing instruction.) Secondly, in cases where students are frustrated or upset at a particular controversial point in the course or disagree with the computer scoring of his answer on a quiz question, the comment routine seems to alleviate this frustration. Students are almost unanimous in indicating that this comment routine is a strong part of the CAI system. In each case, as students take the courses at University Park and make comments, their comments are reviewed by staff members and responses to the comments are posted on a weekly basis. In those instances where a student can justify how his answer is better than the computer's answer in a given quiz he is given an extra point on that particular quiz. Finally, students have assisted in course improvement by pointing out inaccuracies or errors in content or sequencing. The principal investigators have relied heavily on feedback from the students and have made numerous changes as a result of these comments.

In addition to the computer comment routine, a simple card format has been useful. Staff members and students often made comments or suggestions on 3" x 5" cards. As an example of the magnitude of suggestions and comments made by authors, investigators, and students, the number of comments made with the computer comment routine or recorded on 3" x 5" cards was tabulated for the period June 1, 1973 through December 31, 1973.* During that six months period, the principal investigators reviewed the courses on several occassions and made a total of 765 comments on the 3" x 5" cards. Course authors produced 247 card comments, and five graduate students who were reviewing the course made a total of 314 comments. Finally, the students who took the course in Carbondale, Illinois and the few students who were working with the course at University Park prior to December 31, 1974 made a total of 408 comments by means of the computer comment routine. None of those comments referred to quiz questions. Comments regarding quiz questions were not tabulated.

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*June 1, 1973 is the date on which we began to keep the cards. Prior to this date, the programers would destroy the cards simply to make more space for other materials. Literally hundreds of course corrections based on card suggestions were made prior to this time.

Course attitude questionnaire. Spencer's (1968) Course Attitude Questionnaire (CAQ) was selected to provide a general measure of student satisfaction with the courses. The CAQ consists of 50 statements to which the student responds on a 4-point Likert-type scale (strongly agree through strongly disagree). The 50 statements have six empirically determined factors (general course attitude, method of instruction, course content, interest and attention, instructor*, and other).

The CAQ offers three major advantages: its factors are reliable; it is in widespread use and sufficiently well-known to allow comparisons between CARE 2/3 and traditionally taught courses; norms are available which offset the positive response bias present in such instruments. With the permission of The Pennsylvania State University, the CAQ was placed on-line. Student responses to the CAQ are automatically collected and made part of "student records".

This means of evaluating courses is in line with The Pennsylvania State University's current policy toward students evaluation of courses. There is a mandatory evaluation by students of each course. The CAQ will satisfy that policy.

Professional Consultation

There were two levels of professional consultation on the CARE 2/3 project -- internal and external. Internal consultation was also of two levels -- CARE 2/3 project members and informal conferences with other PSU staff members.

At the beginning of the project, a nationwide search was conducted to obtain the professional staff who were competent in the areas of special education or early childhood education and who wished to be involved in computer assisted instruction. The staff recruited were highly confident and came to PSU with high credentials in their respective areas. Four staff members at the Assistant and Associate Professor level were brought to Penn State to work on the project. Each of those persons obtained rank in an academic department in The Pennsylvania State University. At the time of this final report, each of those persons has been maintained on the staff by the department in which he or she has obtained

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*The "instructor" factor refers to the conventional case in which a human instructor provides all the instruction. Questions related to this factor were not included in the CAI evaluation format.

professorial rank. Numerous small conferences among the principal investigators and the professional staff members were held during the project. Incidentally, the size of the entire CARE 2/3 staff was such that it was impractical to have regular meetings with the entire staff (clerical, technical, and professional). Furthermore, the work assignments for the staff members varied from that of clerical through programing through systems analysis to the professional authoring and writing.

The other level of internal consultation was conferences with other staff members in related areas at Penn State. A number of staff members from other departments as well as special education and early childhood education reviewed one or more parts of the CARE courses in various stages of development. Their contributions and suggestions were invaluable and changes were made as a result of their insights.

External consultation was the second major professional consultation employed in this project. Consultants were brought in or worked on their own campuses to assist the principal investigators in covering relevant materials and assuring the investigators that materials were accurate and up-to-date.

Field Tests

In January and February, 1973, ten graduate and undergraduate students went through the entire course (CARE 2) to check it for consistency and continuity in anticipation of a major field trial in March and April. As the students went through the course, their responses and reactions were recorded both on computer tape and with the card system. Each of these students was interviewed from time to time by the authors and the principal investigators. Several students were observed for a length of time as they actually worked through the material. In those instances, the investigators received information from the students as they reacted to the various presentation strategies. Some major adjustments in the course content and sequencing were made as a result of this preliminary trial.

During March and April, 1973, a full scale field test was carried out in conjunction with the Center for Innovation for Teaching the Handicapped, Indiana University, Bloomington, Indiana. The Penn State Mobile CAI Laboratory was located on the IU campus for approximately six weeks. During that time 28 IU students took CARE 2 and received regular credit from Indiana University for

their experiences. Complete performance records were kept for the students and were later analyzed in detail. Also, the students made comments both on computer tape and with the card system. During May, June, and part of July, 1973, the investigators and other staff members revised CARE 2 course and incorporated relevant revisions into CARE 3. Literally hundreds of minor revisions were made at this time based upon thousands of records generated by the students. A second major field test was carried out during July and August, 1973. CARE 2/3 was offered for credit at Southern Illinois University, Edwardsville, Illinois. Approximately 25 students took the course for credit at that time under similar conditions as Indiana University.

During August, September and October, 1973, the investigators reviewed data from the Edwardsville site and continued to make improvements on the course materials. The Edwardsville students made numerous relevant comments and suggestions for improvement. Again, a great number of minor improvements were made to improve the course flow.

The third major field trial began in the middle of October and ran until the middle of December, 1973. Fifteen students at Southern Illinois University in Carbondale, Illinois, took CARE 2 for credit in Penn State's Mobile CAI Laboratory. These students were not aware the course was in the final stages of development. For the first time, all the quizzes and the final exam were on-line for the students to take. It became evident during this field trial that the students had become very quickly accustomed to receiving immediate feedback to any questions that might be asked them. The students were most distressed when we chose not to give them immediate feedback on quizzes that they took during the course. (A similar reaction was obtained from 124 University Park students who took CARE 2/3 in the Winter Term, 1974.) It has been decided as a result of these experiences to randomize the questions and to provide feedback for each quiz question immediately after the question is answered by the student.

As students took the course in Carbondale, some additional technical problems were encountered. These problems were corrected as soon as we were made aware of them.

In January, 1974, the CARE 2/3 courses were offered as regular resident instruction courses at the University Park campus of The Pennsylvania State University. One hundred twenty-four students took the courses during the first

use of these courses as regular non-experimental courses. Also beginning in January, the courses were made available to Penn State University Mobile CAI Laboratories and 50 students enrolled in the courses in those laboratories. (CARE 1, Early Identification of Handicapped Children, and CARE 4, Education of Visually Handicapped Children, are also routinely offered in the three Penn State CAI installations.)

CHAPTER FIVE

SUMMARY

Nearly 4,000,000 handicapped children in the United States are not receiving special educational services that they require in order to become self-supporting, self-respecting citizens. In order to adequately provide for these children almost 300,000 more specially trained persons are needed to work with handicapped children. In addition there is a serious lack of trained personnel to staff day care centers and preschool programs for both normal and handicapped children. The present methods of training educational personnel cannot provide enough people to meet these needs. This project developed an alternative approach to training educational personnel.

The purpose of this project was to develop two computer-assisted instruction courses in diagnostic teaching. The courses were designed to teach regular elementary and preschool teachers and child care workers how to work effectively with children who have learning problems because of mental retardation, cultural disadvantage, emotional disturbances, and/or learning disability. The emphasis is on inservice training of regular classroom teachers (not special educators) and toward preservice and inservice child care workers. The courses are geared especially toward those persons who may not have the opportunity to return to a college campus or other training center for special instruction in teaching handicapped children.

This project demonstrates the use of a new technology in the development and evaluation of innovative curricula for the education and training of teachers and child care workers. It integrates and makes available relevant data and teaching methods developed by federally financed programs in special education and early childhood education.

Personnel in the Department of Special Education, Division of Academic Curriculum and Instruction and the Computer Assisted Instruction Laboratory at The Pennsylvania State University cooperated to develop and program the CAI courses. Developmental phases have been completed and the courses are ready for dissemination and distribution to other agencies and institutions.

Final Product

The final product of the CARE 2/3 course development is a computer tape with related supplementary materials. A print-out of the course frame by frame is 78,000 pages. The number of program statements is unknown as is the number of possible student interactions. The number of possible different paths through the course is probably calculable but given the extensive branching and the high number of interactions, that figure or number of possible branches through the course would be staggering.

Over 2,000 images are shown during the time the student takes CARE 2 or CARE 3. Fifteen hundred slides and 1,200 hand-drawn graphics were used and are stored on three micro image reels. No student will see all of the slides even if he were to take both CARE 2 and CARE 3 because of the extensive branching. Those slides showing children in activities and scenes specified by the course authors were taken with the written permission of the parents of some 160 children and with the cooperation of teachers and staff members of five preschool programs, three public and parochial elementary classes, and two church school programs. In addition, the Day Care and Child Development Council of America, the Fresh Air Fund and VISTA contributed slides and photographs with permission for their use. Graphics work was completed according to directions specified by course authors.

Over 1,200 audio messages are available for use in conjunction with the various chapters. The audio messages range in length from 2 seconds to about 4 minutes. Three professional adult narrators recorded most of the messages and approximately 20 youngsters participated in recording sessions for which children's voices were required.

Written copyright permission was obtained from 13 companies, and several university presses, industries, and individuals to include charts, illustrations, verbatim text, and/or excerpts of works in both on- and off-line course material. Extensive use was made of computer based retrieval systems and federal project reports.

REFERENCES

Anderson, R. H., & Shane, H. G. As the twig is bent: Readings in early childhood education. Boston, Mass.: Houghton Mifflin Company, 1972.

Cartwright, G. P., Cartwright, C. A., & Robine, G. G. CAI course in the early identification of handicapped children. Exceptional Children, 1972, 38, 453-459.

Cartwright, G. P. & Cartwright, C. A. An undergraduate computer-assisted instruction course in the early identification of handicapped children. Proceedings of the 1972 Conference on Computers in Undergraduate Curricula, Southern Regional Education Board, Atlanta, Georgia, June 1972, 167-175. (a)

Cartwright, G. P. & Cartwright, C. A. Gilding the Lilly: Comments on the training based model for special education. Exceptional Children, 1972. (b)

Cartwright, G. P., Cartwright, C. A., & Ysseldyke, J. E. Two decision models: Identification and diagnostic teaching of handicapped children. Psychology in the Schools, January 1973, x(1).

Cartwright, G. P. & Cartwright, C. A. A computer-assisted instruction course in the early identification of handicapped children. Journal of Teacher Education, Summer 1973, 24(2), 128-134.

Evans, E. D. Contemporary influences in early childhood education. New York: Holt, Rinehart and Winston, Cin., 1971.

Frost, J. L. Revisiting early childhood education. New York: Holt, Rinehart and Winston, Inc., 1973.

Gallagher, J. J. The search for the educational system that doesn't exist. Exceptional Children Conference Papers: The improvement of special education through instructional technology, Council for Exceptional Children, Arlington, Va., 1970. (ED 047 442).

Gordon, I. J. Early childhood education. Chicago: University of Chicago Press, 1972.

McLure, W. P., & Pence, A. M. Early childhood and basic elementary and secondary education: Needs, programs, demands, costs. National Educational Finance Project, Special Study No. 1, Bureau of Education, University of Illinois at Urbana-Champaign, 1970.

Palmer, D. D., Shea, B. J., & Cartwright, G. P. Computer assisted remedial education: Early identification of handicapped children. Course Planning Manual. Report R-42. CAI Laboratory, The Pennsylvania State University, University Park, Pennsylvania. June 1971.

Spencer, R. E. The Illinois course evaluation questionnaire manual of interpretation (revised). Research Report No. 270, Office of Instructional Research, University of Illinois. January 1968.

United States Senate. Hearings Before the Subcommittee on Handicapped of the Committee on Labor and Public Welfare. Report No. 93-238. Washington: U. S. Government Printing Office, 1973.

Universal opportunity for early childhood education. Educational Policies Commission, 1966. Cited in Evans, E., Contemporary influences in early childhood education. New York: Holt, Rinehart and Winston, 1968.

ADDITIONAL REFERENCES: DISSEMINATION OF CARE INFORMATION IN REFEREED JOURNALS

Cartwright, G. P., Cartwright, C. A. & Robine, G. G. CAI course in the early identification of handicapped children. Exceptional Children, February 1972, 38, 453-459.

Cartwright, G. P. & Cartwright, C. A. An undergraduate computer-assisted instruction course in the early identification of handicapped children. Proceedings of the 1972 Conference on Computers in Undergraduate Curricula, Southern Regional Education Board, Atlanta, Georgia, June 1972, 167-175.

Cartwright, G. P. & Cartwright, C. A. Gilding the Lilly: Comments on the training based model for special education. Exceptional Children, November 1972.

Cartwright, G. P., Cartwright, C. A. & Ysseldyke, J. E. Two decision models: Identification and diagnostic teaching of handicapped children. Psychology in the Schools, X(1), January 1973.

Cartwright, G. P. & Cartwright, C. A. A computer-assisted instruction course in the early identification of handicapped children. Journal of Teacher Education, 24(2), Summer 1973, 128-134.

Cartwright, G. P., Sedlak, R. A. & Borman, K. G. Using student attitude as an index for gauging improvements following a formative evaluation. College Student Journal, 6(4), December 1972, 3-9.

Hall, K. A. Research papers: 1971. Audio Visual Instruction, 16:6, June/July 1971, pp. 42-44.

Hall, K. A. CARE: Computer assisted renewal education -- an opportunity in Pennsylvania. (With H. E. Mitzel), Audiovisual Instruction, 18:1, January 1973, pp. 35-39.

Hall, K. A. Computer-assisted renewal education. (With G. P. Cartwright and H. E. Mitzel), Phi Delta Kappan, 1973, in press.

Hall, K. A. CARE: Computer assisted renewal education for inservice teachers. In Proceedings of the Third International Congress for the Scientific Study of Mental Deficiency, The Hague, The Netherlands, September 1973.

Lehman, P. E. Teacher training takes to the road. Manpower, May, 1971.

Mitzel, H. E. CAI on wheels. Educational Television, December 1970, 6.

Mitzel, H. E. Mobile computer assisted instruction for inservice teacher education. In S. Winkler, (Ed.) Applications of learning technology: Progress and problems. National Security Industrial Association, Washington, D. C., 1973.

APPENDIX A

Cartwright, G. P., Cartwright, C. A., & Robine, G. G. CAI course in the early identification of handicapped children. Exceptional Children, February 1972, 38, 453-459.

Cartwright, G. P., & Cartwright, C. A. Gilding the Lilly: Comments on the training based model for special education. Exceptional Children, November 1972.

Cartwright, G. P., Cartwright, C. A., & Ysseldyke, J. E. Two decision models: Identification and diagnostic teaching of handicapped children. Psychology in the Schools, X(1), January 1973.

APPENDIX B

Hall, K. A. CARE: Computer assisted renewal education -- an opportunity in Pennsylvania. (With H. E. Mitzel), Audiovisual Instruction, 18:1 January 1973, pp. 35-39.

CARE: Computer assisted renewal education. The Pennsylvania State University, University Park, Pennsylvania. 1973.

APPENDIX C

CARE 2/3 INFORMATION SYSTEM

In the early stages of the project, we sent out several hundred letters requesting reprints, proposals, and other information about current projects which might be related to the CARE 2/3 project. As the responses began to come in to us, we merged the new materials with selected materials from existing collections (including CARE 1). Frances Lamberts, formerly a bibliographer at the Center for Applied Linguistics in Washington, D. C., devised a management scheme which would allow us to keep track of incoming materials. All incoming materials were coded, abstracted, and filed in such a way that project authors (content and specialists) could have ready access to the abstracts and documents.

The attachments illustrate the classification scheme used in the project. Approximately 1,000 abstracts and documents are on file. Files and file access dates are kept in filing cabinets. Most reports and xeroxed materials are found in the files; books and other hardbound materials are found on the right-hand shelf.

The files are numbered as seen on the Summary on the following page; for ease in filing, all documents show the respective number in the right-hand corner. Most documents are abstracted; the abstracts are kept in a separate file preceding the actual documents. Abstracts also carry their respective file number. For cross-referenced items, a xerox of the abstract is found in the secondary file. The actual document is always found in the "Documents" file of its respective main reference.

Attachments: Summary of files
Breakdown of files
Sample entry

SUMMARY OF FILES

A0 EDUCATIONAL METHODS

- A00 General
- A01 Specific early education curricular models
- A02 Early childhood education

A1 DIAGNOSTIC TEACHING METHODS/COMPREHENSIVE INTERVENTION PROGRAMS

- A10 General
- A11 Oral language
- A12 Reading
- A13 Writing
- A14 Arithmetic
- A15 Motor Development
- A16 Sensory-perceptual development
- A17 Social-emotional development
- A18 Comprehensive intervention programs -- handicapped
- A19 Comprehensive intervention programs -- not handicapped

A2 MANAGEMENT PROCEDURES

- A20 Classroom management techniques
- A21 Classroom observation techniques

A3 MODEL TRAINING PROGRAMS FOR SPECIAL-EDUCATION PERSONNEL

- A30 Teacher training
- A31 Parents and Para-Professions

A4 DIAGNOSTIC TEACHING FOR SPECIFIC GROUPS

- A41 Mentally retarded
- A42 Culturally deprived
- A43 Emotionally disturbed
- A44 Learning disabled

A5 INFORMATION SOURCES

- A51 Information centers
- A52 Thesauri
- A53 Terminology
- A54 Professional literature (primary, secondary, tertiary)
- A55 Teacher's handbook

A6 MATERIALS AND OTHER RESOURCES

- A60 Publishers
- A61 Regional Resource Centers
- A62 Instructional Materials Centers
- A63 Other agencies
- A64 Legislation
- A65 National Program on Early Childhood Education
- A67 Referral

A7 OTHER MATERIALS

- A70 Follow-up files
- A71 Programs not directly relevant for CARE 2
- A75 References on general teaching suggestions

A8 EDUCATIONAL DIAGNOSIS

- A80 General
- A81 Teacher assessment: summary of informal testing instruments
- A82 Teacher assessment: copies of informal testing instruments
- A83 Standardized tests

A9 TEACHING PRESCRIPTIONS

- A90 NRRC/P resource teachers
- A91 Other sample prescriptions

BREAKDOWN OF FILES

A0 EDUCATIONAL METHODS

- A00 General
- A01 Specific ECE Curricular Methods
  - Forms
  - Documentation
- A02 Early Childhood Education
  - Forms
  - Documentation

A1 DIAGNOSTIC TEACHING METHODS

- A11 Oral language
  - Data Forms
  - Documentation
  - Testing
- A12 Reading
  - Data Forms
  - Documentation
  - Testing
- A13 Writing
- A14 Arithmetic
  - Data Forms
  - Documentation
  - Testing
- A15 Motor Development
  - Documentation
  - Testing
- A16 Sensory-Perceptual Development
  - Data Forms
  - Documentation
  - Testing
- A17 Social-Emotional Development
  - Data Forms
  - Documentation
  - Testing
- A18 Comprehensive Programs for the Handicapped
  - Program Descriptions
  - Documentation
- A19 Comprehensive Intervention Programs - Not Handicapped
  - General
  - Program Descriptions
  - Documentation

A2 MANAGEMENT PROCEDURES

- A20 Classroom Management
  - Forms
  - Documentation
- A21 Classroom Observation Techniques

A3 MODEL TRAINING PROGRAMS

- A30 Teacher Training
  - Data Forms
  - Documentation
- A31 Parents and Para-Professionals

Files in the remaining categories are not broken down further than indicated in the Summary.

TRAINING PROGRAMS

Early childhood education and educational personnel training program
Western Washington State College, Bellingham, Washington

The philosophy of the child-education program is cognitively oriented. The child is seen as a problem solver and an individual who explores his environment and seeks self expression -- i.e. the dynamics of learning come from within the child. The teacher's role is merely that of arranging the environment to maximize learning opportunities. Included are the broad objectives of the educational program for young children; specifics of instructional methods are not given however. (Also included is a listing of goals for children toward which the teacher is to strive; these are the goals "officially" developed by the Superintendent of Public Schools.)

The general goals of the personnel-training aspect of the program are listed, e.g., persons must know and be able to apply at least four methods of studying children (i.e., rating scales, anecdotal records), must have diagnostic skills using both formal and informal techniques, must be able to keep records and report on children's progress; must be able to develop and maintain good relationships with other relevant adults, especially parents whom he should be able to involve in the children's education -- parent involvement is an important aspect of the program. Foci and purposes of the training are described in detail.

Measurement instruments (described but not named) reflect the program's orientation, stressing self concept, attitudes and group processes more than achievement.

Descriptors

Early childhood education
Educational methods
Teacher training

APPENDIX D

COURSE DEVELOPMENT WITH AN AUTHOR-ORIENTED LANGUAGE

Karl G. Borman

INTRODUCTION

An authoring system for the IBM 1500 Instructional System has been developed and implemented at The Pennsylvania State University's Computer Assisted Instruction Laboratory. The system, entitled Teacher-Authored Coursewriting Language (TACL), was designed by Dr. Terry A. Countermine in partial fulfillment of the requirements for a Doctorate of Education in the Computer Science Department of The Pennsylvania State University.

The TACL system is designed to be an easy-to-learn language for CAI curriculum development efforts. It is an English-language oriented, general-purpose CAI coursewriting language which is both quick to learn and easy to use. The modular design yields an open-ended system, which may be easily extended.

There are several reasons for the development of the TACL system. The first and perhaps the most important is the amount of time required to develop an hour of CAI instructional material. With current systems, it is estimated that approximately 100 hours of preparation time are required to produce one hour of student course material. The TACL system, however, is designed to decrease the amount of preparation time to 50 or 60 hours for each hour of student course material. The TACL system produces the same high quality course which would have been produced using the current coursewriting system. Also, the ease with which TACL is learned leads educators who would normally shy away from the technical features or problems associated with the computer, to realize that the computer and CAI are powerful tools which they can use to improve the quality of education.

With present preprocessor systems, many features of the basic coursewriting languages are lost or limited. The TACL system, however, seeks to retain most of the features and strategies available with the 1500 Coursewriter II language. Although this has not been totally possible it was of

utmost concern among course authors and was therefore strongly considered in the initial design of the system. The TACL system, a batch-processing type of preprocessor, allows input during the normal working day on the 1500 system by way of the Cathode Ray Tube (CRT). As data are input via the CRT, they are written onto magnetic tape and stored for later, off-hours processing. The TACL requests are processed overnight and TACL listings are returned to the authors in the morning. Upon receiving the listings, the authors may use the editing facilities of the TACL system. Once the author has edited the chapter, he returns to the 1500 system and inputs those changes via the CRT. The procedure is repeated when the TACL author or inputter requests that his edited chapter be processed and he receives a new listing which reflects his changes.

CHAPTER ONE

Introduction

TACL Overview

Teacher-Authored Coursewriting Language (TACL) is a programing language which is designed to reflect the sequence of events used by teachers designing and planning an interactive instruction lesson. The first step in the process is to formulate the overall objectives. For example, the overall objective may be to develop competencies in the area of educational measurement to enable a teacher to properly interpret test scores. The objective is sufficiently broad that a complete "chapter" may be devoted to the development of the objective.

Once the overall objective is formulated, specific objectives should be formulated. A specific objective might be when the student is given the heights of various children, he will be able to indicate each child's position on a bar graph. The material used to develop the concept of bar graphs is then organized into "frames" which are presented to the student.

After one or two frames have been used to present information to the student the general procedure is to request a response from the student to determine if he has understood the material. In order to evaluate the student's response, the teacher would list the possible answers that may be given by a student and make a note as to the possible cause or misunderstanding that caused the student to make the particular response. Additional information should then be presented to the student to correct the misunderstanding. For example, the student might be asked to add 3 plus 2.

If the answer is 5, then the child understands the concept of addition and should proceed to the next objective.

If the answer is 6, the student probably multiplied and should be told the difference between multiplication and addition. After the information is presented, the student should repeat the frame.

If the answer is 1, the student probably subtracted instead of adding and should be given additional information. After the information is presented, the student should repeat the frame.

TACL is designed to reflect the steps outlined above.

The first step is to present information to the student. After sufficient information has been presented (generally after no more than 2 or 3 frames) the student is required to answer a question designed to test his understanding of the material. In order to evaluate the student's response, the teacher lists the possible answers that may be given by the students and makes a note of which material to present to the student if he does make one of the anticipated answers.

Overview of IBM 1500 Instructional System

The IBM 1500 Instructional System (hereafter referred to as the system) is uniquely suited for interactive individualized instruction. TACL is designed to utilize the full capabilities of the system.

The course author only needs to familiarize himself with the components associated with the student station as seen in Figure 1.

Information Presentation

There are three methods of presenting instructional material through the student station. The cathode ray tube (CRT) is the device most often used for presenting information to the student. The CRT is similar in appearance to a small television screen on which appear lines of text and specially designed line drawings. The screen, consisting of sixteen horizontal rows and forty horizontal columns can display up to 640 characters.

The image projector is used for showing photographic images contained on a 16 mm film. The images can be either black and white or color and are of much greater detail than the line drawings shown on the CRT. Each photographic image contains a unique number which can be referred to in the TACL program.

The audio unit is used to play audio messages contained on a magnetic tape. Each audio message is given a unique number which can be referred to in the TACL program.

Response Devices

A light pen device is attached to the CRT and enables the learner to respond to displayed letters, figures and graphics, which appear on the CRT,

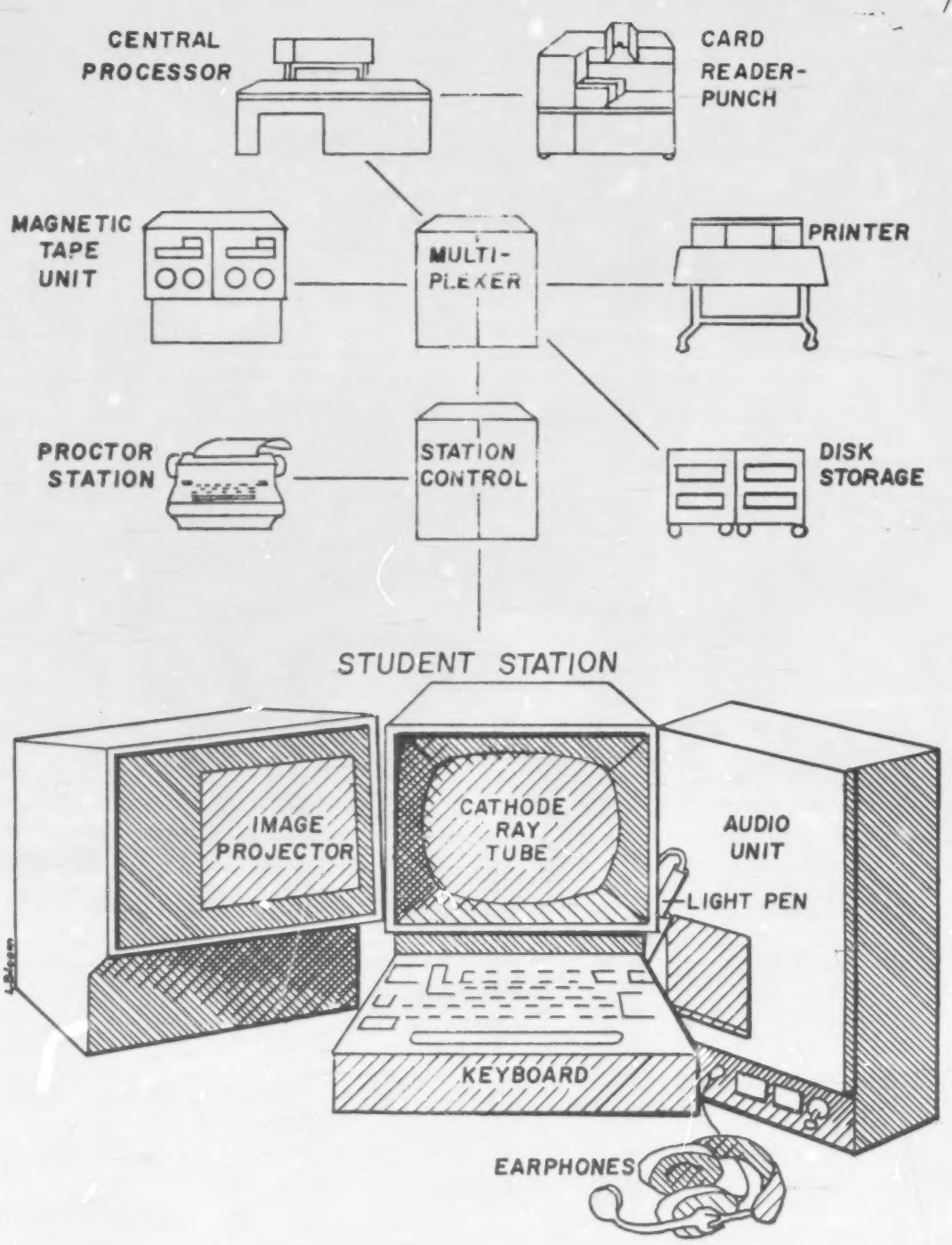

CENTRAL PROCESSOR
CARD READER-PUNCH
MAGNETIC TAPE UNIT
MULTI-PLEXER
PRINTER
PROCTOR STATION
STATION CONTROL
DISK STORAGE
STUDENT STATION
IMAGE PROJECTOR
CATHODE RAY TUBE
AUDIO UNIT
LIGHT PEN
KEYBOARD
EARPHONES

Figure 1.

by touching an appropriate space on the screen. The computer identifies the touched area and performs the TACL instruction associated with that area.

Also attached to the CRT is a typewriter-like keyboard. The student responds by typing an answer which is then matched with the ultimate answers supplied by the TACL program.

Coding Sheets

There are three different coding sheets for use when writing instructional material using TACL. A separate coding sheet is available for each of the three methods of information presentation: CRT, image projector, and audio unit.

CRT authoring sheets. Special coding sheets have been designed to aid the author in arranging text to appear on the CRT. In addition to formulating the text, the authoring sheets are also used to describe the flow of the course.

The center grid of the authoring sheet represents the display area of the CRT. Each character requires two rows and one column of the grid. Therefore, 40 characters across and 16 lines down may be presented at any given time. The bottom line of the grid (rows 30 and 31, columns 29 thru 39) should not be used as they are reserved for the frame label and special instructions which signal the student that he must make a lightpen or keyboard response. The lower portion of the authoring sheet is used for feedback or for additional TACL instructions.

All instructions for the display should be written on the authoring sheet, i.e., anticipated answers, instructions for showing images, instructions for playing audio messages. TACL instructions should be written to the left of the grid. All other instructions, or special requests, should be written on the right of the grid.

The authoring sheets are numbered sequentially. Each successive number should correspond directly to a new frame. In most cases a frame requires more than one authoring sheet to describe a problem. When this occurs, the author should subhead continuous pages of the same problem with the letters "a" through "z." For example, the first page of the second frame would be numbered 2; the next page of the second frame would be 2a; the third page of the second frame, 2b, etc.

Two sample frames are shown in Figures 2 and 3. Note that in Figure 2, the title page is numbered page 1; that the first frame is numbered page 2; and that each character requires two lines and one column. It is not necessary that lines of text begin on an even or odd numbered row. The only requirement is that each character occupy two rows.

Image request sheets. All images are described on the image request form (Figure 4) and should accompany the authoring sheets.

The image form includes: 1) author's name, 2) course name, 3) date, and 4) unique image number assigned by the course coordinator. Requests may be for 35 mm slides which will be transferred to film at a later time. Particular attention must be paid to the horizontal format that is required of all images as well as to the legibility standards.

Audio message request sheets. Audio messages are written on the audio message program sheet (Figure 5) and should accompany the CRT authoring sheets. The audio sheet includes: 1) the course name, 2) author's name, 3) the date, 4) the chapter identifier, 5) the message number which can not be repeated within the chapter, 6) the number of "emphasis" marks and 7) the message.

All activity at a terminal stops while an audio message is playing. However the audio message can be halted temporarily to allow some other activity to run at the station. For example, one may want to show an image in the middle of the audio message, or place some text on the CRT. An emphasis mark (two slashes) is used to indicate the point(s) at which the audio message should pause or allow the other activity to occur. Care should be taken to place emphasis marks at places where a pause would normally appear (e.g., at the end of a sentence) since there is a noticeable pause within the message.

Coding Conventions

In order to provide consistency between the authors and the text presented on the CRT, image projector, and/or audio unit, it is necessary to keep the following conventions in mind.

Vertical lists. A colon is commonly used to introduce a list. Except for complete sentences, the items begin with lower case letters and there is no closing punctuation.

The Pennsylvania State University
The Computer Assisted Instruction Laboratory

Page 1

Label _____ Audio _____ Image _____

FRAME

CHAPTER 7

INDIVIDUAL DIFFERENCES AND NORMALITY

Figure 2.

Label
Audio
Image
Page 2
SUPPOSE WE ARE INTERESTED IN STUDYING
THE HEIGHT OF THE EIGHT-YEAR-OLD
CHILDREN IN OUR HOME TOWN.
ONE OF THE QUESTIONS WE WOULD
PROBABLY WANT TO ASK IS, "HOW TALL ARE
MOST OF THE EIGHT-YEAR-OLD CHILDREN?"
THE MOST DIRECT WAY OF FINDING THE
ANSWER TO THE QUESTION IS BY MEASURING
EACH CHILD AND RECORDING THE DATA.

Figure 3.

☐Photograph ☐Drawing IMAGE PLANNING FORM Image No. 25

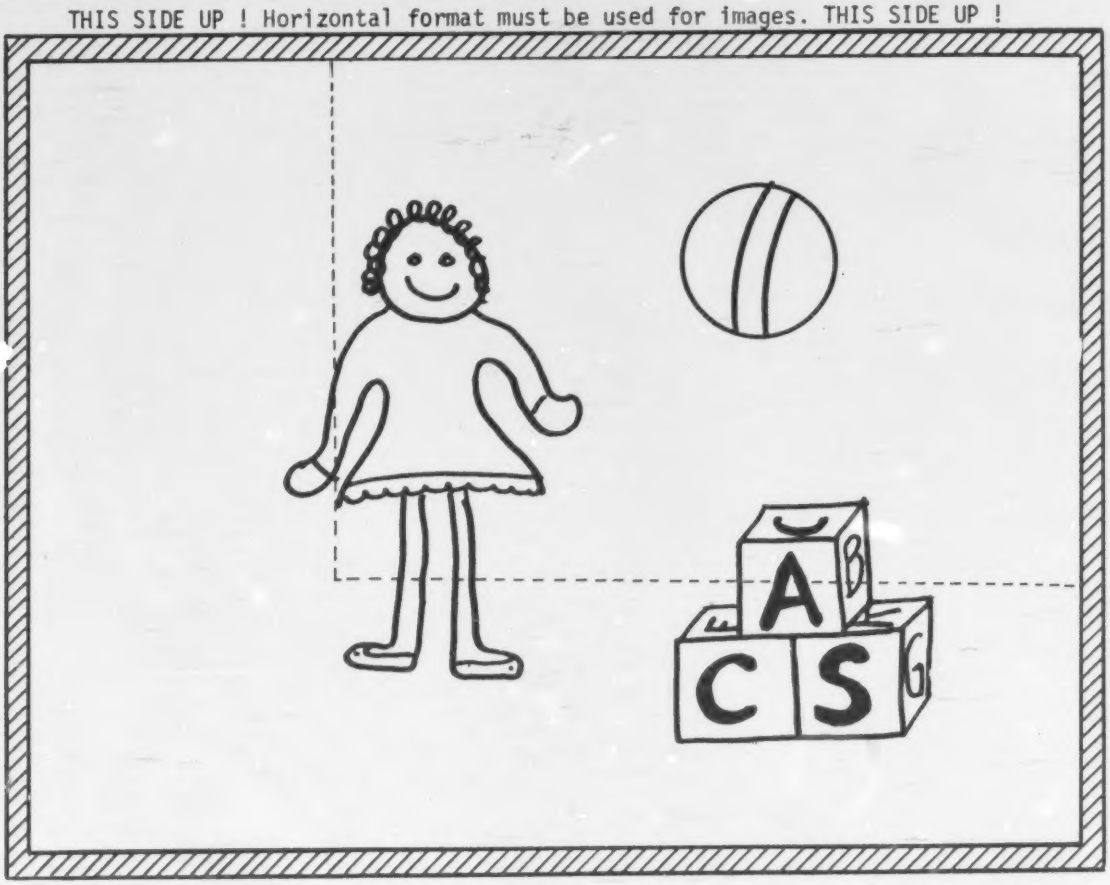
Date 4-73 Author J. DOE Date Required _____ Course REFER

SPECIAL INSTRUCTIONS _____

3 TOYS, I.E., BALL, DOLL, BLOCKS,

Please use the space enclosed by dotted lines for typewritten copy. If the material will not fit when typed in this space, it will not be legible on the finished image. Use the large rectangle for drawing - remember to use letters no smaller than the minimum size* (18 pt.) in the large rectangle, and typewritten size in the small (dotted) rectangle.

THIS SIDE UP ! Horizontal format must be used for images. THIS SIDE UP !



*this is the minimum size

Figure 4.

AUDIO MESSAGE PROGRAM SHEET - CAI Laboratory

Course Name: Refer Segment: _____ Symbol Table Name: _____ Date: 4-73 Page: 1/1

Author: J. Doe Recorded by: _____ Date: _____ Assembled by: _____ Date: _____

Programmer: _____

Message No.	Course Label	Ans. Code	Code	Symbolic Name	Set I.D.	No. Emp. Mks.	Track	Address	MESSAGE
6						1			A CHILD'S IMAGINATION CAN BE STIMULATED BY TOYS. //
									NOTICE THE IMAGE. . .

Figure 5.

Example:

There are four types of reliability to be concerned about in this course. They are as follows:

1. test-retest
2. equivalent forms
3. inter-scorer
4. intra-scorer

Example:

There are two important generalizations which can be stated with considerable confidence. They are as follows:

1. In general, retarded children do not develop as fast as normal children.
2. Retarded children do not progress or develop to the same levels as normal children.

Punctuation. Commas and periods always lie inside the quotation marks; colons and semicolons, outside question marks; and exclamation points vary with the construction of the sentence.

Paragraph indentation. Within a frame, the number of spaces indented for paragraphs should be consistent.

Spacing after punctuation. One space should be left between the punctuation at the end of a sentence and the beginning of the next sentence.

Things to avoid.

1. Avoid hyphenation.
2. Avoid alternate coding the first word of a sentence.
3. Avoid underlining groups of words. It is better to underline individual words.
4. Avoid skipping a varying number of rows between lines of text.
5. Avoid the use of:

	Instead use:
headphones, headset	earphones
image projector, slide, display	image
light pen	lightpen
space bar	spacebar